LOUISIANA DEPARTMENT OF WILDLIFE & FISHERIES

OFFICE OF FISHERIES

INLAND FISHERIES SECTION

PART VI-B

WATERBODY MANAGEMENT PLAN SERIES

LAKE BISTINEAU

LAKE HISTORY & MANAGEMENT ISSUES

CHRONOLOGY

DOCUMENT TO BE UPDATED ANNUALLY

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STRATEGY STATEMENT

Recreational

Sportfish species are managed to provide a sustainable population while providing anglers with the opportunity to catch or harvest numbers of fish adequate to maintain angler interest and efforts. Bass anglers are afforded the opportunity to catch an occasional trophy fish through the introduction of Florida largemouth bass.

Commercial

Lake Bistineau does not support large numbers of most rough fish species that normally comprise a commercial fishery. Flathead and channel catfish are present in good numbers in the lake and are managed for their recreational value.

Species of Special Concern

No threatened or endangered fish species are found in Lake Bistineau.

EXISTING HARVEST REGULATIONS

Recreational

Statewide regulations have been in effect for all species since impoundment. The recreational fishing regulations may be viewed at the link below:

http://www.wlf.louisiana.gov/regulations

Commercial

Use of gill nets, trammel nets, fish seines, and hoop nets are prohibited on Lake Bistineau. The commercial fishing regulations may be viewed at the link below:

http://www.wlf.louisiana.gov/regulations

SPECIES EVALUATION

Largemouth bass

Lake Bistineau has long been popular for recreational fishing activities. Annual aquatic vegetation and leaf litter accumulations throughout the years have led to habitat problems from the buildup of these organic materials on the lake bed. Degraded spawning substrate, poor water quality and reduced angler access have adversely impacted sportfish populations and recreational fishing activities in the lake. Annual drawdowns were conducted on Lake Bistineau from 1966 to 1971 in an effort to control the water hyacinth on the lake. Figure 1 depicts fisheries standing crop estimates from rotenone sampling during the period of 1970 through 2000. Standing crop estimates derived from rotenone sampling during 1970 to 1975 indicate a relatively low production of recreational and forage fishes during this period. It is unclear whether the drawdowns or the habitat problems associated with the overgrowth of water hyacinth had a greater impact on the fish populations. Standing crop estimates indicated more abundant fish populations beginning in 1975. The drawdown in 1975 could have been an important factor in the dramatic increase in forage production, as aquatic habitats have been shown to improve following drawdowns (Lantz, 1967). Fish populations peaked in 1977 and slowly declined thereafter. Forage fish production increased sharply again following the drawdown in 1983. However, the recreational fish populations did not respond to this increase in forage production, likely due to the decline in habitat on the lake.

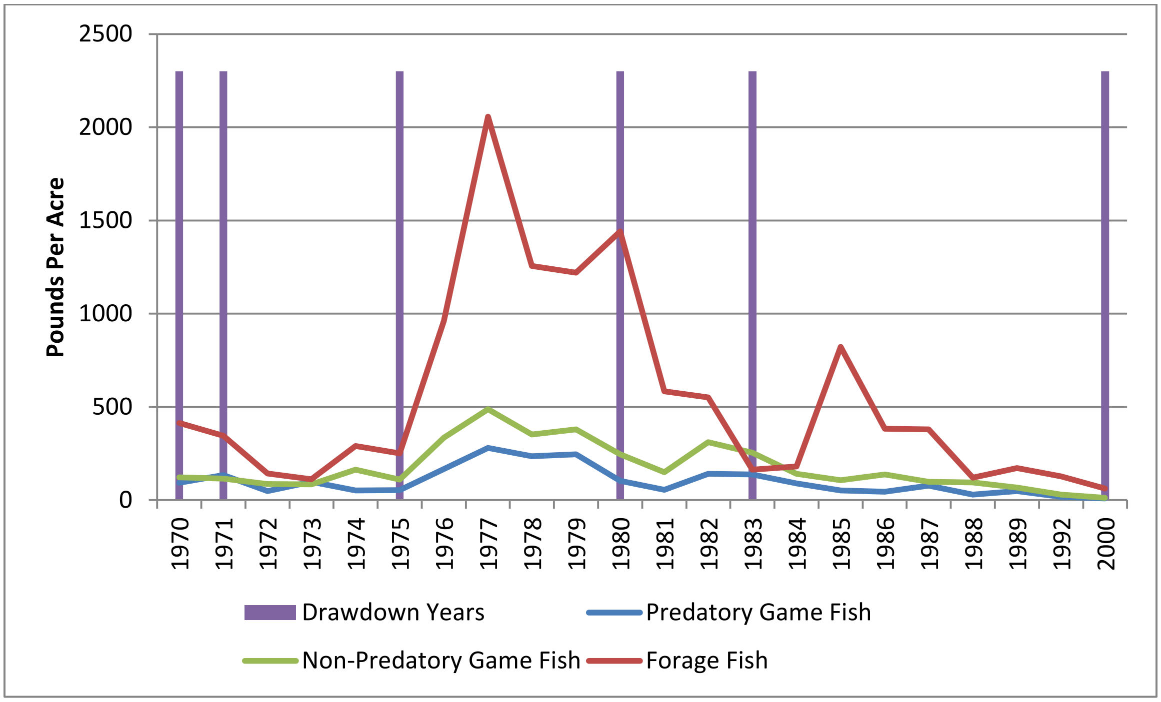

Figure 1. Standing crop estimates of fish production in pounds per acre from Lake Bistineau, Louisiana as determined from rotenone samples taken from 1970 – 2000.

Catch-per-unit-of-effort (CPUE: fish/hr.) trends derived from electrofishing samples indicate that declining habitat quality on Lake Bistineau may have negatively impacted several species of sportfish in the lake, including sunfish, crappies, and bass. The CPUE for quality-size or greater largemouth bass [those ≥12" in total length (TL)] from spring electrofishing samples is shown in Figure 2. Numbers of quality-size largemouth bass collected by electrofishing began a steady decline following the spring of 2000. This trend continued until spring 2006 when their relative abundance began to increase. Figure 3 indicates that the CPUE of stock and sub-stock-size largemouth bass from spring electrofishing samples followed a similar trend, with the population rebounding following the drawdowns in 2004 and 2005. The CPUE of largemouth bass under 12" TL in the 2012 sample increased greatly from previous years following the extended drawdown from September 2009 through January 2012. Recruitment remained high in the 2013 spring sample as the strong year class from the extended drawdown period grew to stock size (≥8" TL), the substock fish (<8" TL) declined to more normal levels. The 2013 spring sample showed a significant increase in both quality (≥12" TL) and preferred-size (≥15" TL) largemouth bass.

It is well documented that drawdowns stimulate fisheries production in southern waterbodies. Anecdotal information provided by Lake Bistineau anglers point to increased angling success for several sportfish species following the drawdowns of 2004 and 2005, which were implemented for fisheries habitat improvement. Many anglers reported greater catches of sunfish following these drawdowns, including catching significant numbers of bedding sunfish for the first time in many years. Largemouth bass and crappie anglers also reported good angling success following the drawdowns. Anglers continue to report increased success as the frequency of mid-summer drawdowns for salvinia control has increased. LDWF sampling results support the angler's reports. When trend lines are applied to spring electrofishing results, largemouth bass show a steady increase in CPUE over the last 10 years (Figure 3). Seine haul samples also indicate good reproduction of young-of-the-year (YOY) largemouth bass, crappie and bream following the drawdown years. A similar trend was also noted for largemouth bass captured in gill nets (Figure 5).

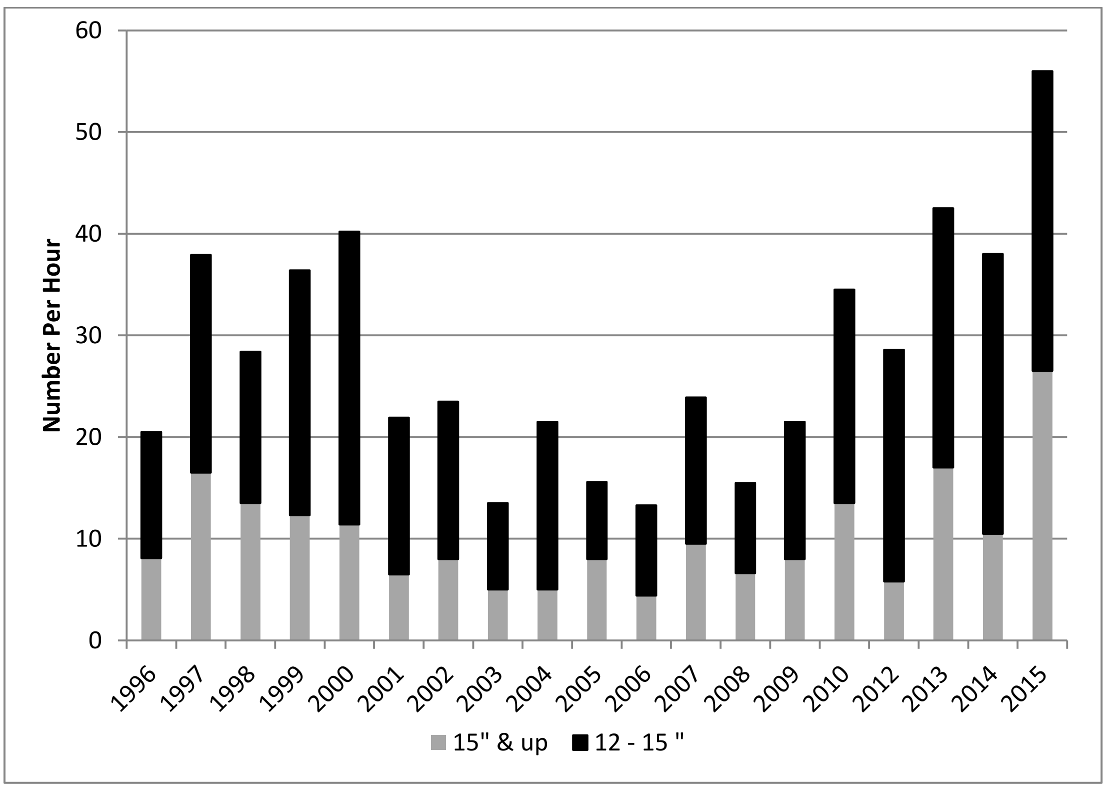

Figure 2. The catch-per-unit-of-effort (CPUE) of quality- (≥12") and preferred-size or larger (≥15") largemouth bass from Lake Bistineau, Louisiana from 1996 – 2015 spring samples.

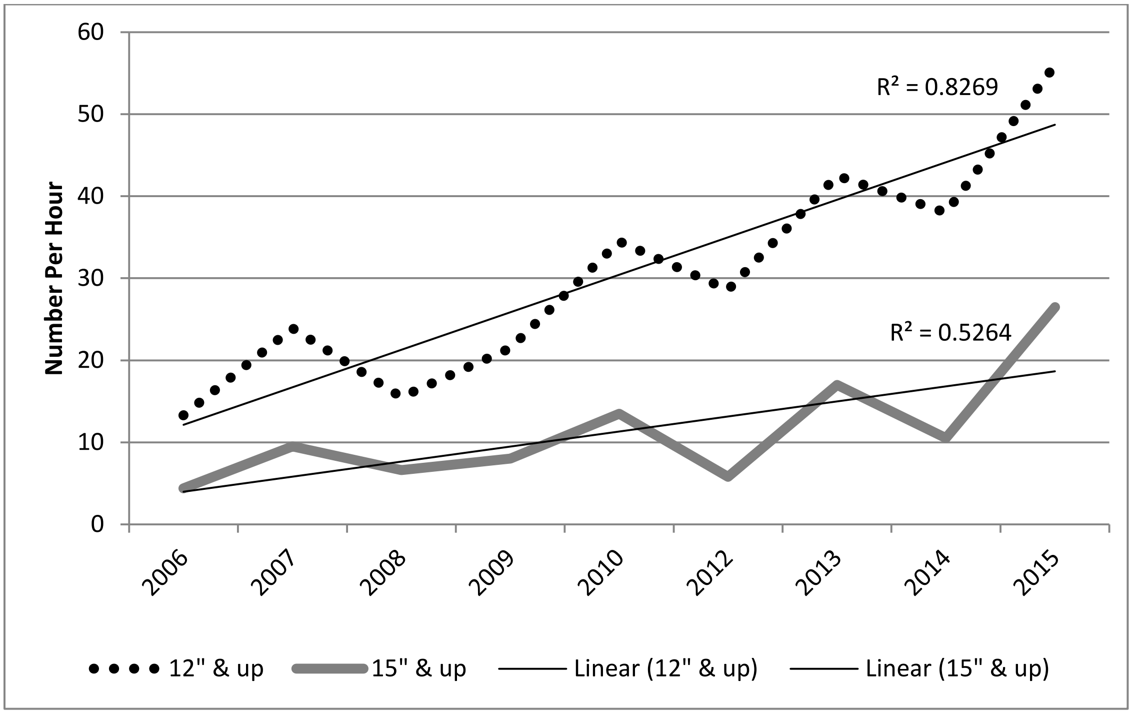

Figure 3. The catch-per-unit-of-effort (CPUE) of quality- (≥12" TL) and preferred-size or larger (≥15" TL) largemouth bass from Lake Bistineau, Louisiana from 2006 – 2015 spring samples-post mid-summer drawdown implementation.

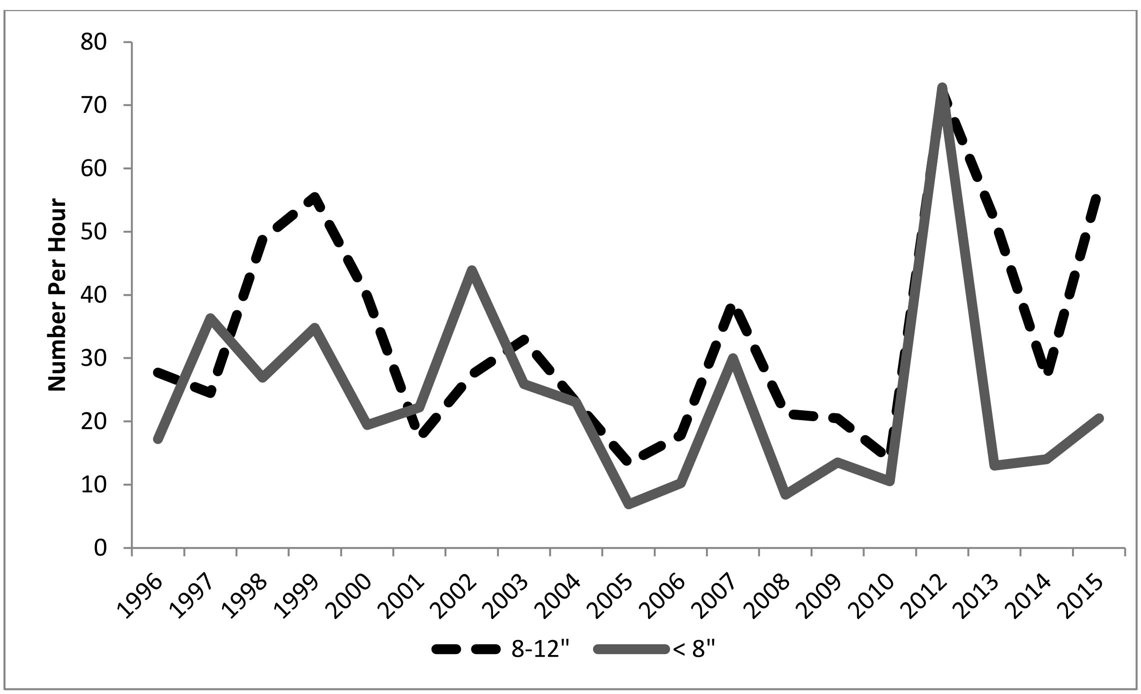

Figure 4. The catch-per-unit-of-effort (CPUE) for stock- (8" - 12" TL) and substock-size (≤ 8" TL) largemouth bass from Lake Bistineau, Louisiana from 1996 – 2015 spring samples.

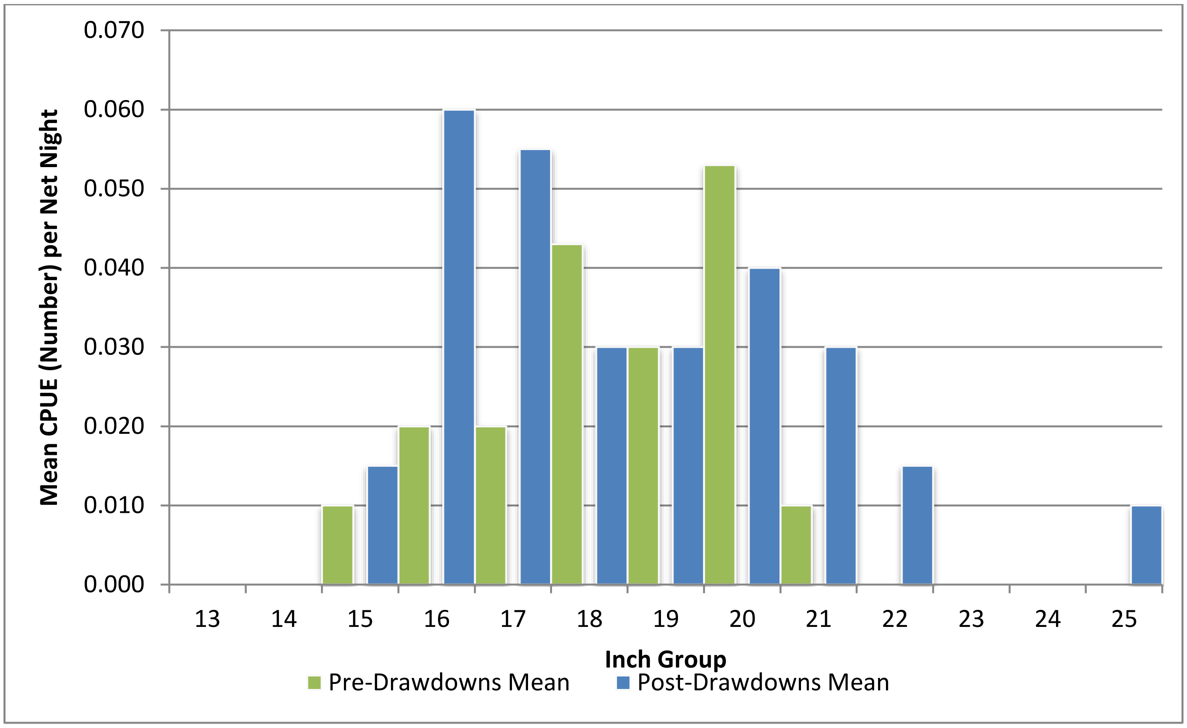

Figure 5. The catch-per-unit-effort (CPUE) for largemouth bass from Lake Bistineau, LA, from gillnets for pre-drawdowns (1996, 2004, 2005) and post-drawdowns (2008, 2015).

The average catch per seine haul of YOY fish is depicted in Figure 6. Seine sampling conducted from 2001 to 2009 indicates adequate forage in the lake through the 2007 sample. Samples collected in 2009 were likely biased due to giant salvinia (*Salvinia molesta*) coverage present at many of the sample sites. From the observed increase in numbers of individuals captured in 2007, sunfish populations responded well to the 2004 and 2005 drawdowns.

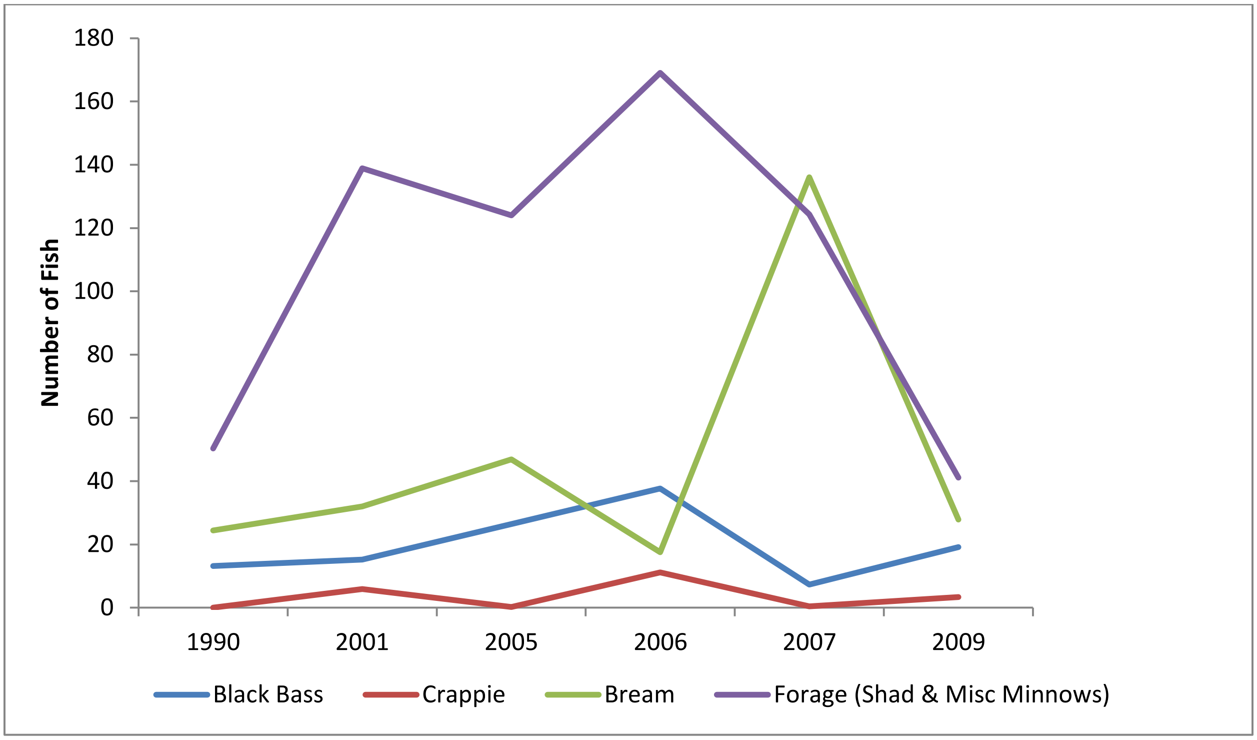

Figure 6. Catch per seine haul of small fish (≤ 5" TL) which included YOY largemouth bass, forage species (e.g., shad, minnows), crappie, and bream captured in Lake Bistineau, LA from 1990 – 2009.

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Forage fish are those that are available for use as food by predatory fishes. In general, all individuals up to six inches in length are forage fish, particularly when discussing forage for largemouth bass. Forage samples are collected in conjunction with fall standardized electrofishing samples. Standard procedures for collecting these samples were changed in 2011 in an attempt to get a more representative sample of the entire lake. Prior to this time, samples were only collected at one location each year. Shorter duration samples are now collected at four separate locations each fall. Forage sampling conducted by electrofishing in the fall from 2011-2015 resulted in a mean catch of 43.1 pounds per hour of forage fishes. Figure 7 shows the mean number per hour of forage fish species collected for Lake Bistineau from 2011-2015.

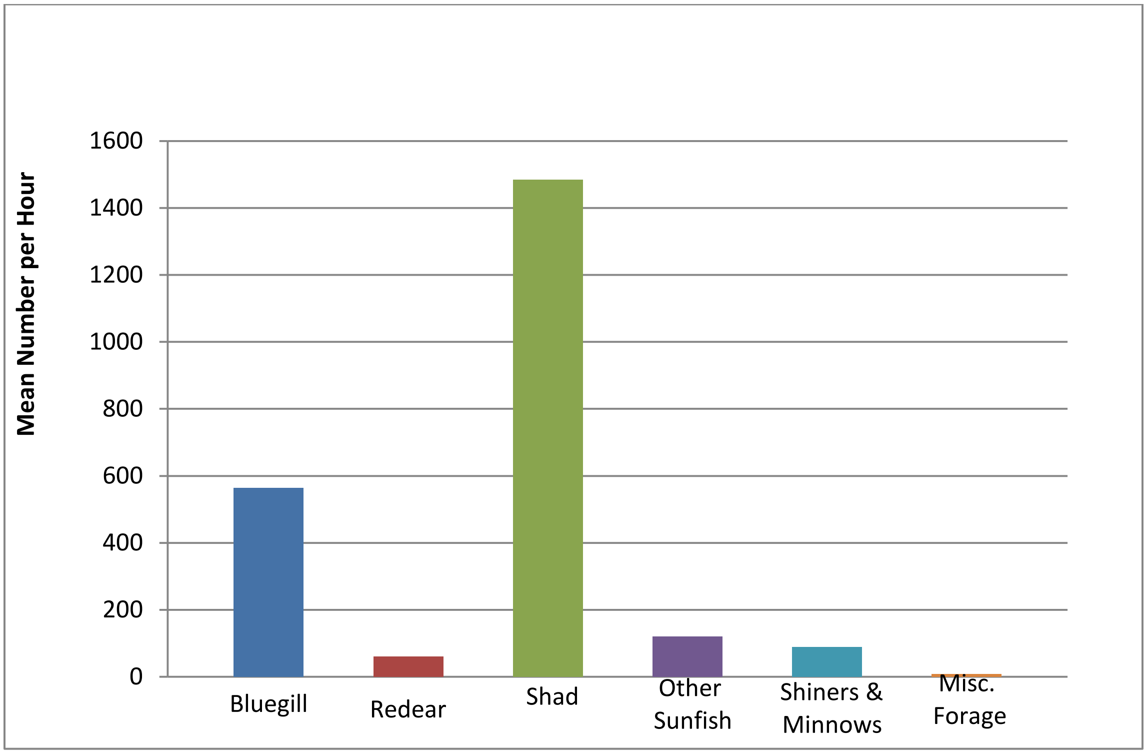

Figure 7. The mean catch-per-unit-of-effort (CPUE) of fishes ≤ 5" TL captured in Lake Bistineau, LA, for forage samples from 2011-2015.

Forage sampling results, combined with relative weight (Wr) results for largemouth bass, indicate that Lake Bistineau continues to have adequate forage to sustain a healthy fishery. Predation rates on these fishes should be high during drawdown periods. The improvements to bottom habitats and the subsequent increase in spawning activities of all species associated with drawdowns are sufficient to provide ample forage for the predator fish of Lake Bistineau. Figure 8 below shows the change in Wr's of largemouth bass collected from spring electrofishing on Lake Bistineau since the frequency of mid-summer drawdowns has increased. There has been a marked increase in Wr's of all size largemouth bass since 2006, and especially for those sizes sought by anglers (12-20-inches TL). To further illustrate the change that has been observed the mean Wr for largemouth bass 12-20-inches TL collected from fall electrofishing has increased from 96.44% (1990-2003) to 102.69% (2003-2015).

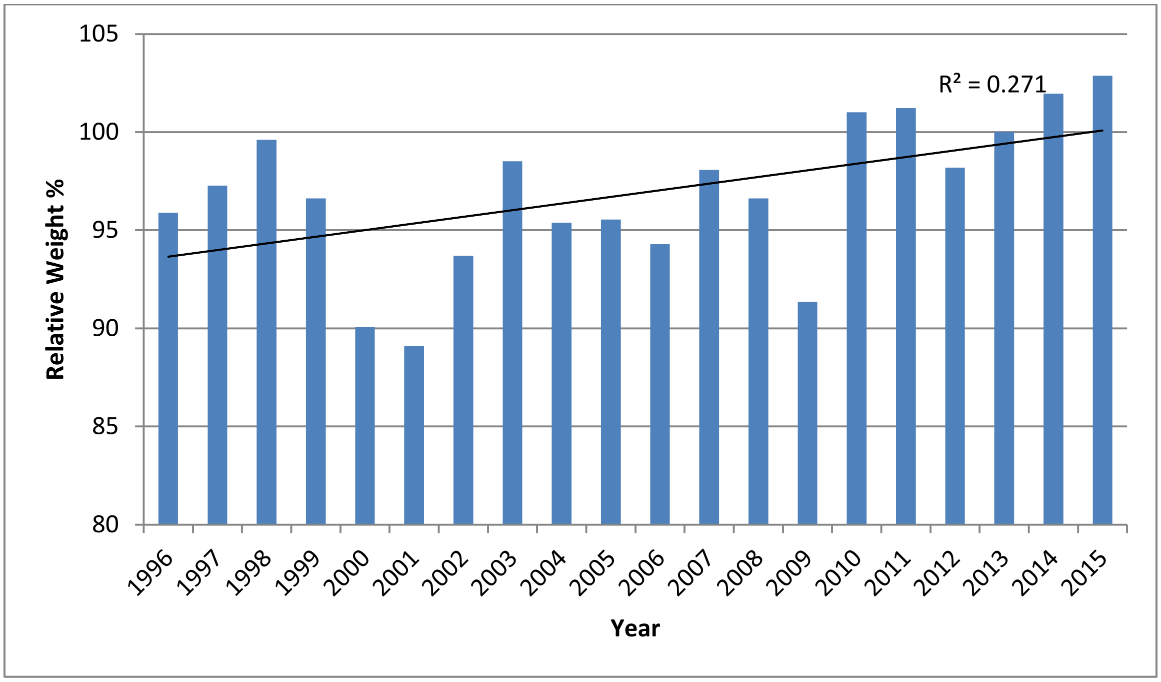

Figure 8. The mean Wr's of quality- and preferred-size largemouth bass (12-20" TL) from Lake Bistineau for spring electrofishing samples 1996-2015.

Proportional stock density (PSD) and relative stock density (RSD) are size-related structural indices used to numerically describe fisheries length-distribution data. Proportional stock density compares the number of bass of quality-size (≥12 inches TL) to the number of bass of stock-size (≥ 8 inches TL). The PSD is expressed as a percentage. A fish population with a high PSD consists mainly of larger individuals, whereas a population with a low PSD consists mainly of smaller fish. Relative stock density compares the number of bass of a given size range to the number of bass of stock-size. Another common calculation used in fisheries management is RSD-Preferred (RSD-$_P$). This value compares the number of largemouth bass ≥ 15 inches TL to the number of stock-size largemouth bass in the population. This is also commonly called RSD-$_{15}$ values. Ideal PSD and RSD-$_P$ values for a balanced largemouth bass population range from 40-70 and 10-40, respectively. Fall electrofishing samples indicated that the Lake Bistineau largemouth bass population typically fell below the desired ranges for both statistics prior to the implementation of regular mid-summer drawdowns for the control of giant salvinia. Starting in 2006, PSD's and RSD's began to increase and have been within the desired ranges every year since 2009 (except 2011). The 2011 PSD and RSD values are lower due to an excessively large number of YOY bass collected that fall following the extended 2010 drawdown and drought (Figures 9 and 10).

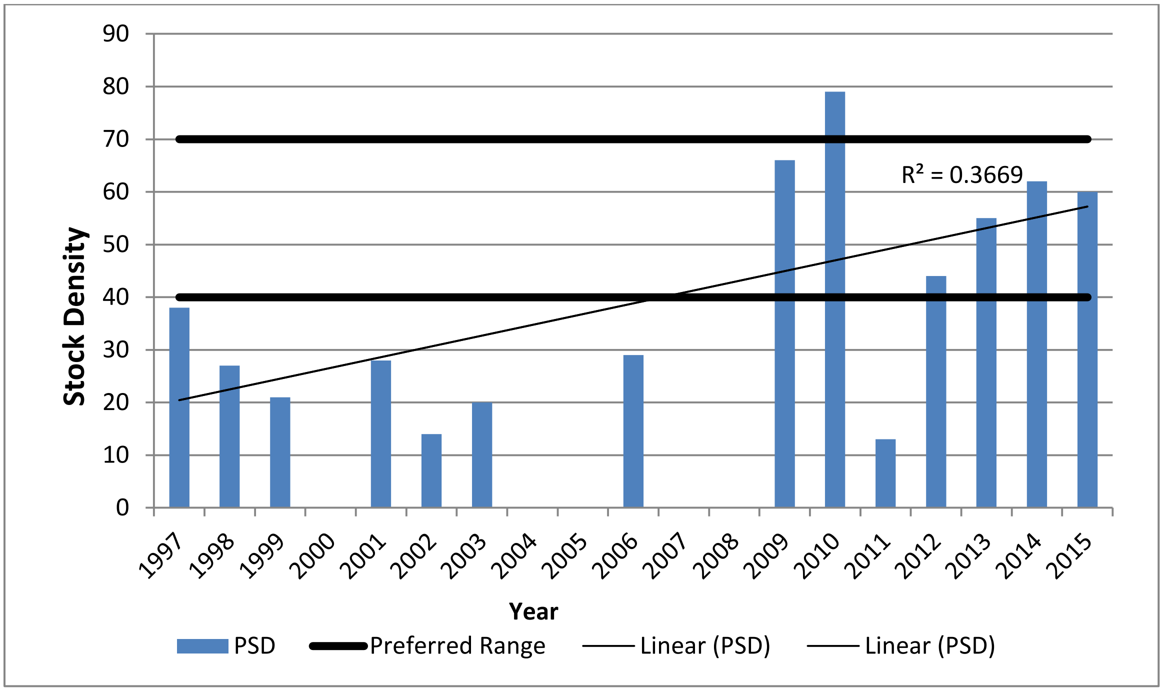

Figure 9. Proportional stock density for largemouth bass collected on Lake Bistineau, LA, during fall electrofishing from 1997 to 2015.

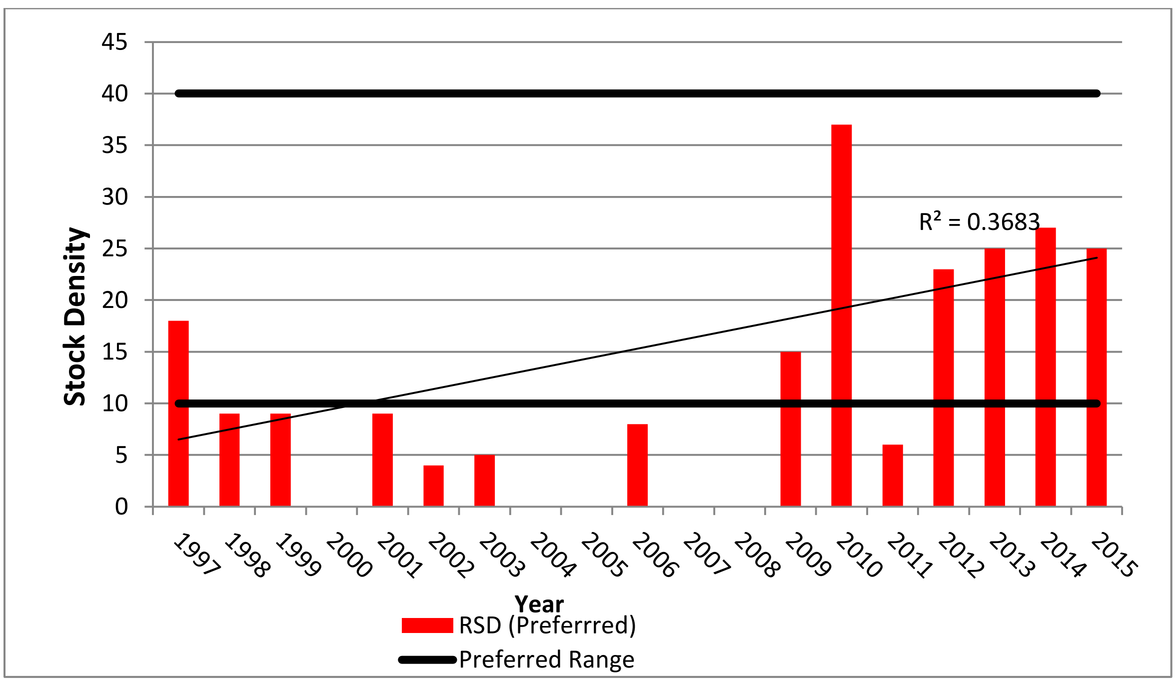

Figure 10. Relative stock density (preferred) for largemouth bass collected on Lake Bistineau, LA, during fall electrofishing from 1997 to 2015.

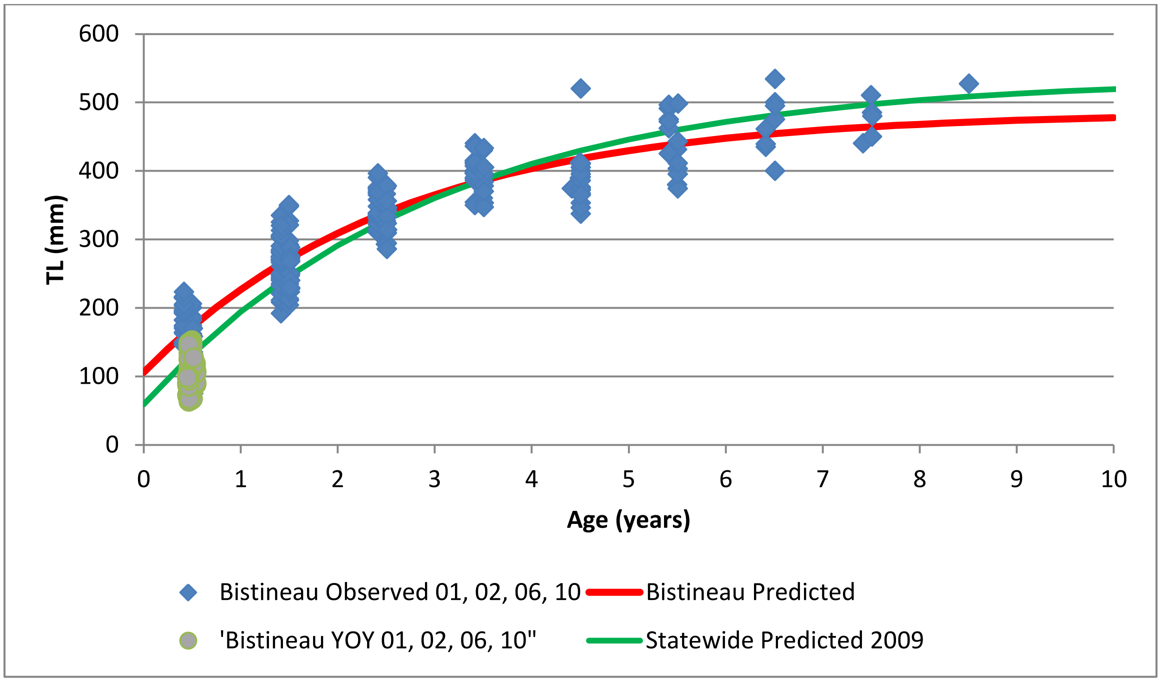

Figure 11. Observed and predicted total length-at-age of Lake Bistineau, LA largemouth bass collected from 2001, 2002, 2006, and 2010, as compared to rates for statewide stock assessments (2009-2012, n=1,378).

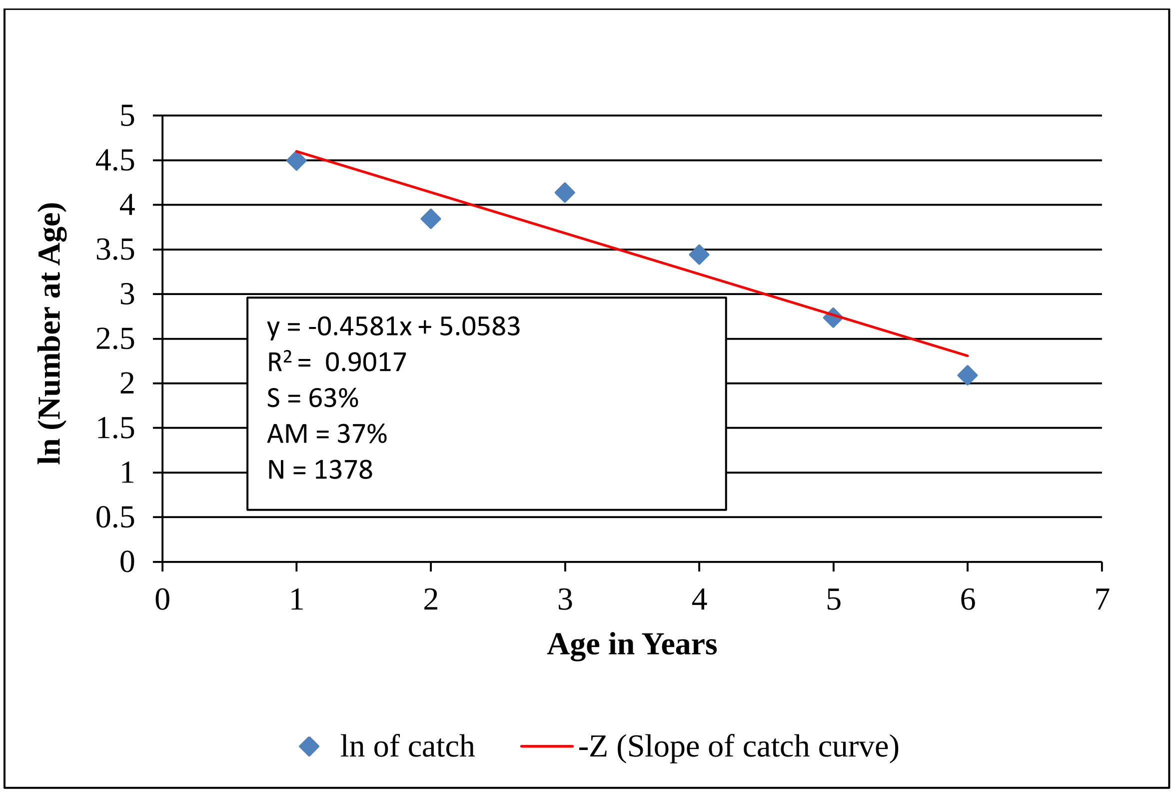

Figure 12. Annual mortality (AM) and corresponding survival rate (S) of largemouth bass from Lake Bistineau, LA for samples collected in 2001, 2002, 2006 and 2010 (n = 1,378).

In Figure 12, un-aged fish in samples were assigned ages from an annual age length key. –Z = slope of descending catch curve; S = survival rate; AM = annual total mortality (which includes mortality due to fishing and natural causes); N = sample size. Survival and mortality estimates were derived from catch-at-age projections from the age-length key.

Age and growth samples from largemouth bass in Lake Bistineau were collected in 2001, 2002, 2006, and 2010. The samples indicate good growth rates for all ages (Figure 11). Predicted growth rates for largemouth bass from Lake Bistineau (von Bertallanffy; t_0 =- 0.6443, $L_{inf=}$ 485.996, and k=0.38203) closely relate to the statewide predicted average growth rate (von Bertallanffy; t_0 = -0.2676, L_{inf} = 494.4469, and k = 0.4320). Growth rates exceed the statewide average for ages 1-4 and are slightly lower for older bass. This slower growth in older fish may be explained by relatively low sample sizes of these age classes. Figure 12 depicts the mortality and corresponding survival rates for largemouth bass. These values were derived from the descending slope of the catch curve and are 37% and 63%, respectively.

Genetics

Florida largemouth bass stocking began on Lake Bistineau in 1998 when Bass Life Associates, Inc. funded the purchase of 468,328 fingerlings. Prior to 1998, the lake was maintained as a refuge for the native largemouth bass and free from the Florida genotype. Stocking was continued annually from 1998 until 2003. Stockings were sporadic between 2004 and 2013 as the frequency of mid-summer drawdowns increased. When it became apparent that the bass fishery was responding positively to the drawdowns and that drawdowns were likely to occur frequently, annual stockings of Florida bass were continued. To date, more than 3 million Florida largemouth bass have been stocked into Lake Bistineau. Results from genetic testing are shown in Table 1. Genetic analysis has shown an increase in the Florida genome even with the sporadic nature of stockings from 2003 - 2013. There has been an increase in the number of largemouth bass greater than 20 inches TL collected in gill nets since 2005, including two bass captured in 2008 that exceeded 14 pounds.

Table 1. Genetic Analysis of Largemouth Bass from Lake Bistineau, LA from 1989 – 2010.

Year	Number	Northern	Florida	Hybrid	Florida Influence
1989	60	100%	0%	0%	0%
1990	15	100%	0%	0%	0%
1995	34	100%	0%	0%	0%
1997	73	100%	0%	0%	0%
2001	52	94%	6%	0%	6%
2002	51	90%	0%	10%	10%
2006	64	92%	0%	8%	8%
2010	80	80%	1%	19%	20%

Crappie

The crappie population on Lake Bistineau is comprised primarily of black crappie. White crappie were occasionally collected during rotenone sampling conducted from 1970 – 2000. The number of available-size crappie (>7” TL) collected during rotenone sampling was highest during the 1970’s when drawdowns were more frequently conducted on the lake. Few crappie were collected in the early 1980’s (see Figure 13). It is difficult to determine the reason for the change in population, but severe infestations of water hyacinths during the early 1980’s may have been a factor. There also seems to be a general reduction in the crappie population from the period 1970 – 2000 which is typical of the decreased fisheries production in an aging reservoir. Crappie reproduction was fairly consistent most years with very high numbers of fingerling crappies collected in rotenone samples in 1978 and 1984 (Figure 14). The high number of fingerling crappie in the 1984 sample is likely due to the drawdown in 1983, in association with record cold temperatures. Coverage of water hyacinth had been problematic prior to the drawdown and freeze in 1983. The 1978 rotenone sample indicated even higher numbers of fingerling crappie. This is following a drawdown in 1975 and occurred during a time when aquatic vegetation was not a major problem on Lake Bistineau. Crappie size distribution from frame net sampling during 1991 is shown in Figure 15. Length structure for crappies 7” TL and larger is represented by a classic bell curve on the right side of the graph.

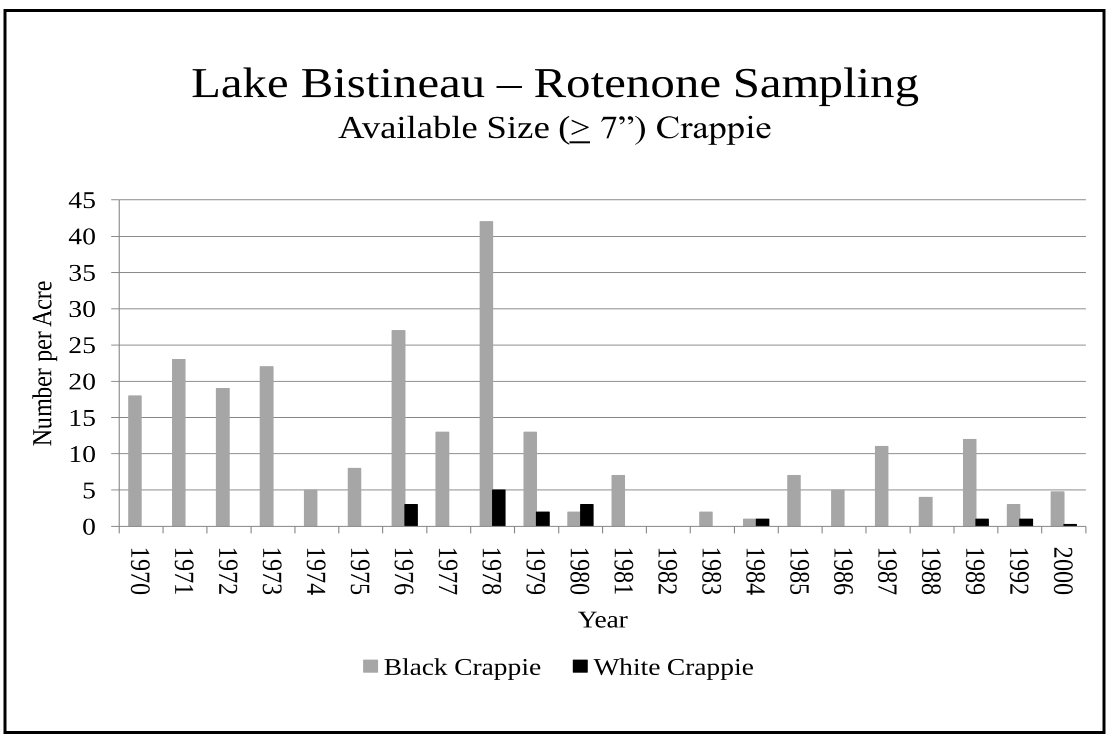

Figure 13. Estimated number per acre of available size crappies derived from biomass (rotenone) sampling on Lake Bistineau, LA, from 1970 – 2000.

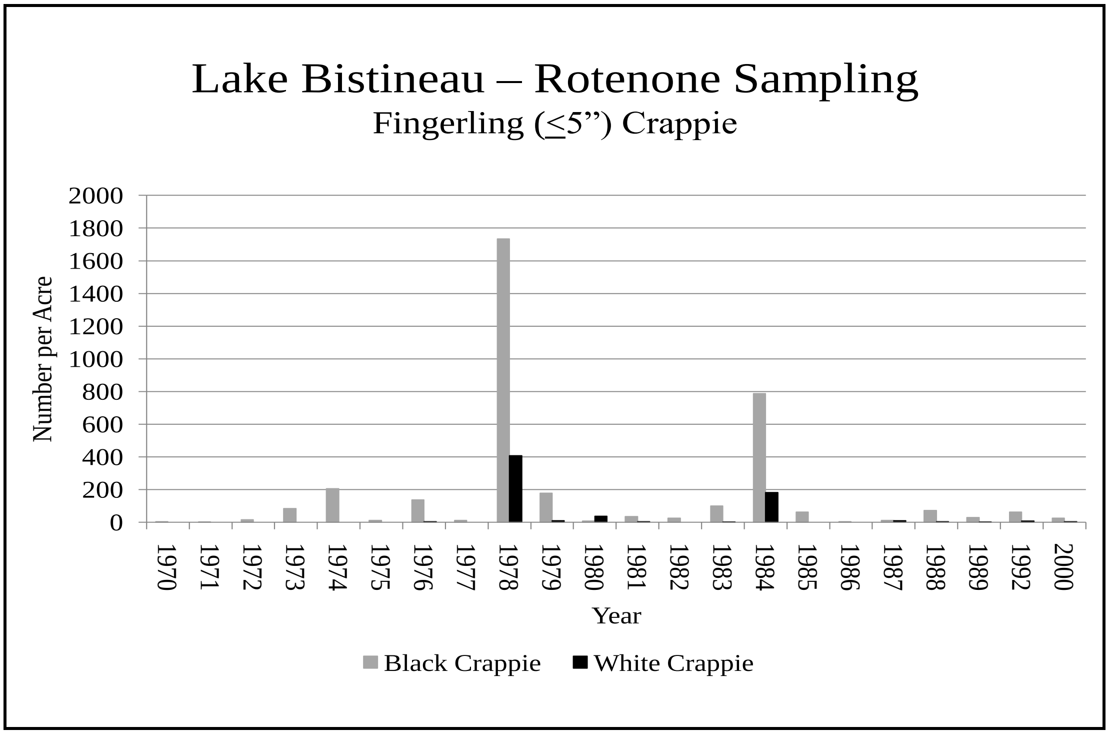

Figure 14. Estimated number per acre of young-of-the-year (YOY) crappies derived from biomass (rotenone) sampling on Lake Bistineau, LA, from 1970 – 2000.

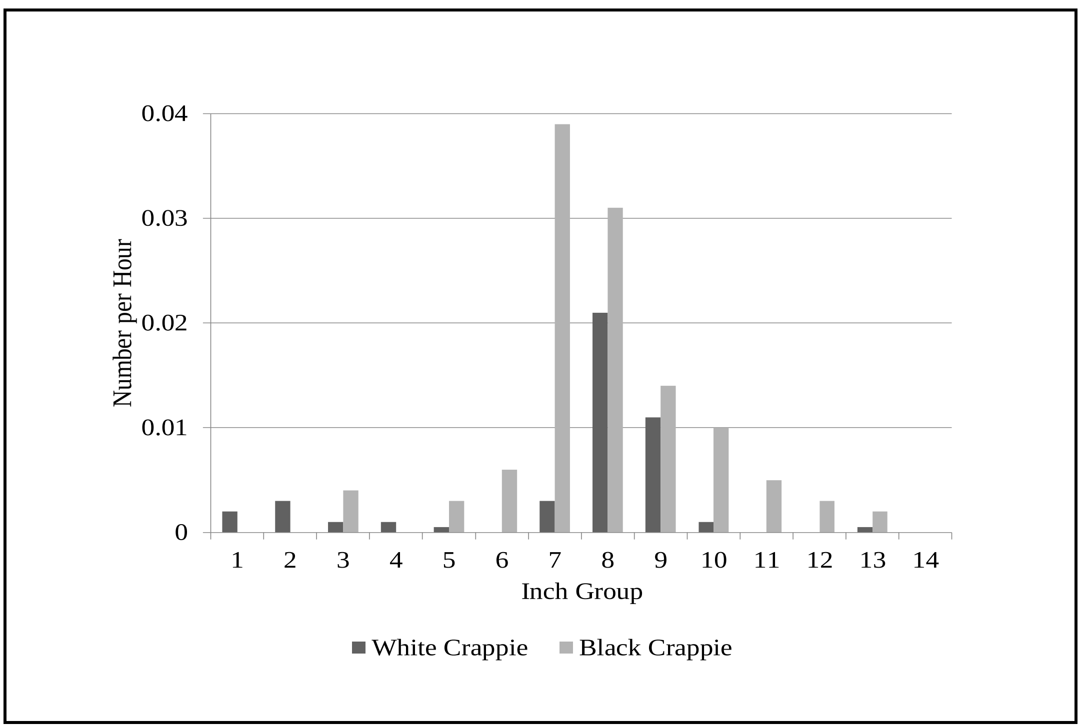

Figure 15. The CPUE (number per net hour) of black and white crappies collected from frame nets on Lake Bistineau, LA, 1991.

Anecdotal information suggests that angler catches on Lake Bistineau indicate a more abundant crappie population than existing LDWF data would suggest. In recent years, LDWF has used lead net gear to collect crappie to gain better information on their populations. While lead nets have not been fished on Lake Bistineau, plans are to use this gear to assess crappie populations from 2016-2018.

Catfish

Lake Bistineau does not support large populations of commercial fish other than catfish. No significant commercial fishing activity occurs on Lake Bistineau due to the restrictions on commercial gear in the reservoir. Channel catfish and flathead catfish are commonly sought by recreational anglers using trot lines, set lines, yo-yo's and rod and reel.

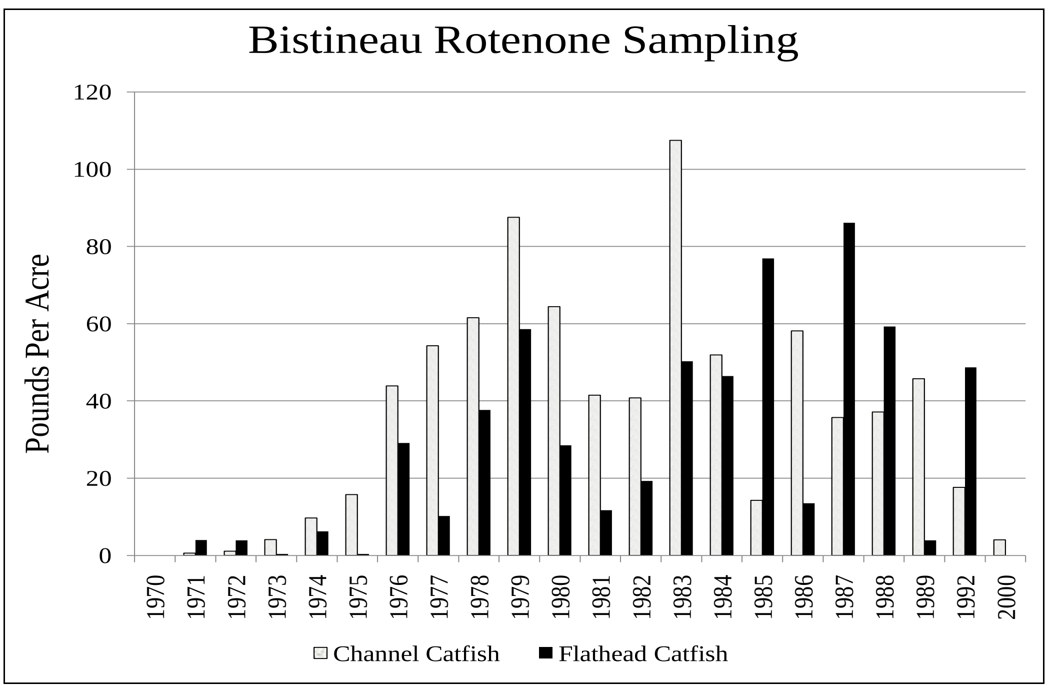

Figure 16. Estimated standing crop of channel catfish and flathead catfish in pounds per acre derived from rotenone sampling on Lake Bistineau, LA from 1970 – 2000.

Channel catfish and flathead catfish collected from rotenone sampling from 1970 through 2000 are depicted in Figure 16. Rotenone sampling conducted from 1976 to 1992 indicates robust populations of channel catfish and flathead catfish in the lake. Sampling from 1970 through 1975 indicates relatively low catfish populations. Lake Bistineau underwent a series of annual drawdowns from 1966 to 1971 in an effort to control water hyacinth. The population of channel catfish and flathead catfish improved significantly following the drawdown in 1975. Results from 1976 show a marked increase in these fish along with most sportfish species in the lake. The lake continued to support good populations of catfish for a number of years. Catfish collected utilizing standardized sampling gill nets are shown in Figure 17. A decline is indicated from gill net sampling of 1996 and rotenone sampling of 2000. The population again began to increase in the 2005 gill net samples and climbed higher in the 2008 gill net samples. A fall / winter drawdown was conducted in 2000 for vegetation control and bottom habitat improvement. Midsummer drawdowns were conducted in 2004 and 2005 to for the purpose of improving the bottom fisheries habitats. It is apparent that improvements in channel and flathead catfish populations are positively correlated with the drawdowns. The increase in the channel catfish population is likely due to improvements in the bottom substrate and benthic invertebrate production. An increase in sunfish and other forage fishes is likely responsible for the increase in the flathead catfish population.

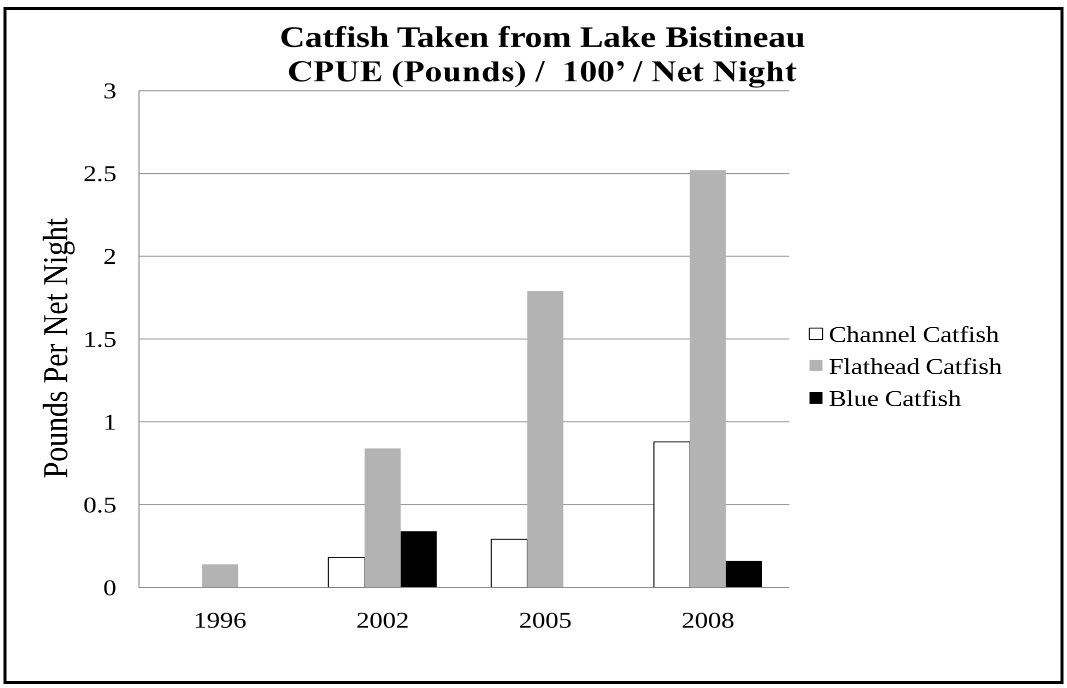

Figure 17. Catch-per-unit-of-effort of catfish depicted by species in pounds per net night taken by gill nets from Lake Bistineau, LA 1996, 2002, 2005, and 2008. All standard sizes; 2.5”, 3”, 3.5”, and 4” square mesh.

HABITAT EVALUATION

Aquatic Vegetation

Lake Bistineau is a unique ecosystem. Although a man-made impoundment, the lake environment is more similar to a natural swamp setting. Therefore, the management of Lake Bistineau needs to be unlike other "typical" reservoirs. Lake Bistineau is heavily forested with cypress trees which cover approximately 50% of the 17,200 surface acres of the lake. The lake has had problems with aquatic vegetation since impoundment. Before that time, the natural water regime included high water levels in the spring and low water levels in the late summer and fall. The large expanses of nutrient rich shallow water are ideal habitats for many species of aquatic vegetation. Several different species of aquatic vegetation have become problematic over the years. Recently, giant salvinia has caused major problems on the reservoir. At times, the plant has formed dense mats over large areas of the lake adversely affecting fisheries habitat and limiting boating access. Drawdowns have been conducted annually since 2008 in response to the salvinia growth. These annual drawdowns have virtually eliminated all other species of aquatic vegetation on the lake. Only alligator weed remains in certain shallow areas.

Historically, one of the primary methods of dealing with aquatic vegetation problems on Lake Bistineau has been the use of drawdowns. The first drawdown for control of aquatic vegetation on Lake Bistineau began in 1945 and drawdowns have been used with varying degrees of success since that time. The lake was dewatered in 1951 to allow for the construction necessary to raise the pool level by 4 feet. By 1955, the lake was again experiencing vegetation problems. A proposed management plan was drafted by LDWF biologists calling for annual drawdowns of the lake to improve fishing, waterfowl, and to reduce aquatic plants. The plan called for drawdowns of 3-4 months duration beginning prior to September 1 each year with the gates to be closed between December 1st and 15th. This plan was met with controversy and never implemented. The aquatic resources in the lake began to decline.

In 1966, a series of five consecutive 5-foot post Labor Day drawdowns for control of water hyacinths and other aquatic vegetation was initiated. In 1975, a post Labor Day drawdown for vegetation control was conducted. Following a mild winter in 1982, water hyacinth coverage increased tremendously and the one spray crew assigned to the lake could not keep pace with the growth. Spray crews from throughout the state were assigned to Lake Bistineau beginning in April 1983. The crews treated over 5,000 acres of water hyacinths, but surveys conducted in August 1983 revealed that 30% (5,160 acres) of the lake surface was completely matted with water hyacinth and an additional 10,320 acres (60%) was moderately infested. A post Labor Day drawdown in 1983, followed by record cold temperatures in January of 1984, provided excellent control of the water hyacinths.

Hydrilla was first observed in 1995. A fall / winter drawdown was attempted in 1996 in response to that discovery. The lake never dewatered significantly due to heavy rain, but significant control of hydrilla was observed due to high, turbid water the following spring. A post-Labor Day fall / winter drawdown was conducted in 2000. The drawdown was conducted as a dual purpose management action. The dewatering improved fisheries habitat by allowing organic matter on the lake bed to dry and decompose. Aquatic vegetation control benefits were also achieved. Alligator weed and water hyacinth covered most of the upper end of the lake and was problematic in other areas. Other shallow water areas had extensive coverage of submersed aquatic vegetation. Positive results were achieved prior to heavy rains in November and the subsequent refill of the lake.

Drawdowns conducted in 2004 and 2005 were primarily for consolidation of bottom sediments and reducing organic matter on the lake bed. These drawdowns also impacted the aquatic vegetation on the lake. Prior to the 2004 drawdown, Lake Bistineau had extensive coverage of water hyacinth, alligator weed and primrose. The upper end of the lake was almost totally blanketed. Many shallow areas throughout the lake also had very extensive coverage of submersed aquatic vegetation. Hydrilla had increased in coverage, although not to problematic levels. Many areas of the lake had become nearly impassable to boat traffic due to the aquatic vegetation and buildup of organic matter on the lake bed. Following the 2004 mid-summer-winter drawdown, much of the submerged vegetation and water hyacinths were significantly reduced. However, alligator weed and water primrose expanded in coverage and were problematic in some areas. A drawdown conducted from July 15, 2005 through the end of January 2006 provided control for a short time. Unfortunately, by June of 2006, areal coverage of alligator weed and water primrose was in excess of 2,000 acres.

Giant salvinia, which is a free floating aquatic fern native to Brazil, was discovered on Lake Bistineau in March of 2006. Primary stage plants were found widely scattered over the lower 1/3 of the lake. Early efforts were conducted with the goal of eradication. Spray crews from other LDWF districts were included for assistance. Despite the extensive effort, it soon became evident that the plant was too widespread for eradication to be a possibility.

Giant salvinia has the potential to double in biomass every 3-5 days. In Lake Bistineau, salvinia coverage expands at a tremendous rate, doubling every 10 days during the prime growing season. Lake Bistineau is heavily forested in many areas, providing sheltered nursery areas where the salvinia grows prolifically. Foliar herbicide applications are difficult in many of these areas.

Spray crews from District 1 spent a large portion of their time during the summer of 2007 making herbicide applications in an effort to control giant salvinia. Crews from other districts were called in to assist beginning in August 2007 and continuing through the fall. Herbicide applications made for giant salvinia control in 2007 totaled 4,156 acres. Despite the effort, giant salvinia increased from 500 acres in April to approximately 4,500 acres in December.

Several nights of subfreezing temperatures in January 2008 caused some damage to the salvinia. Plants in the more open areas of the lake were most affected. Little effect was observed on salvinia protected by tree canopy. Those plants were still green and even exhibited new growth in many instances. High water caused the removal of a large volume of salvinia as water flowed over the spillway. These natural controls reduced coverage from 4,500 acres to an estimated 2,208 acres for the beginning of the growing season in April 2008. At that time, mats several inches thick had formed in many areas. Recognizing the seriousness of the problem, the LDWF Secretary committed significant resources to Lake Bistineau and designated it as department's testing grounds for salvinia control measures.

Seventeen LDWF spray crews participated in an intensive herbicide application effort during April 7-11, 2008. In that time frame, the crews applied 1,499 gallons of EPA-approved AquaMaster™ herbicide to 2,016 acres of giant salvinia. Eighteen LDWF spray crews treated 2,886 acres of aquatic vegetation with 2,157 gallons of AquaMaster™ herbicide from April 28 to May 1, 2008. For the two efforts, over 4,900 acres of aquatic vegetation were treated with 3,656 gallons of herbicide. Though mats of giant salvinia were thinned, areal coverage was reduced by only 25%. Salvinia coverage increased to 3,340 acres by June 26, 2008 and to 4,500 acres by July 15, 2008.

A drawdown for control of giant salvinia was conducted between July 15, 2008 and January 30, 2009. The lake was dewatered 8 feet at a rate of 2-3 inches per day to minimize the downstream transfer of giant salvinia and to maximize salvinia left on the exposed shoreline. Foliar herbicide applications by LDWF spray crews continued in water accessible by boat throughout the drawdown period.

Estimates made on October 11, 2008 indicate that coverage levels had been reduced to less than 1,000 acres from 4,500 acres when the drawdown began. A type map survey conducted during March 13–19, 2009 indicated 850 acres of giant salvinia present following the drawdown. The majority was located in the mid-lake area which contains old slough channels that could not be reached by boat during the drawdown period.

Giant salvinia increased to 1,500 acres by May 1, 2009, and remained concentrated in the middle section of Lake Bistineau. The largest infestation was located in areas adjacent to Bistineau State Park Areas 1 and 2. Heavy rains and a resulting rise in lake level beginning on May 3, 2009, flushed large quantities of salvinia down to the lower end of the lake. With warming temperatures, salvinia began to expand rapidly. Coverage increased to 4,300 acres by June 5, 2009, despite ongoing herbicide applications and a significant quantity of plant material being flushed over the spillway during a high water event.
Foliar herbicide applications were made by LDWF spray crews to over 3,800 acres of giant salvinia in 2009. An additional 800 acres was treated by a private contractor prior to curtailment of foliar herbicide applications in mid-July. On July 13, 2009 the LDWF Secretary announced a new direction to control giant salvinia on Lake Bistineau. At that

time a biologist was assigned to oversee the salvinia control efforts on Lake Bistineau and formulate an effective long term strategy. In 2010, the Lake Bistineau Rehabilitation Plan was completed (see Lake Bistineau MP-C archives).

Salvinia weevils (*Cyrtobagous salviniae)* were introduced into two enclosures in August 2007. The weevils survived the first winter and their populations increased in the enclosures. Weevil infested salvinia in the two original enclosures was transferred to floating enclosures designed to fluctuate with water level. Weevil infested salvinia was also distributed to areas with limited access to establish "nursery areas".

Additional weevil infested salvinia was stocked in October 2008 from a LSU rearing facility near Gheens, Louisiana. A major weevil stocking effort began on June 15, 2009. During the two week effort, over 78,000 lbs. of giant salvinia infested with over 1.8 million adult weevils were relocated to Lake Bistineau. The weevils were stocked in an area which sustains water during a drawdown and has harbored giant salvinia for over two years. Containment devices were placed to hold the weevil-infested salvinia in the stocking location.

An initial application of Galleon herbicide was made on June 11, 2009. In preparation, SePRO Corporation contracted with Remetrix to conduct bathymetric surveys of the treatment areas. LDWF provided boats and personnel in assistance. Prior to the application, LDWF District 1 personnel deployed and marked approximately 9,500 feet of floating containment devices including 3,400 feet of oil spill containment boom. During this application, 192 gallons of Galleon herbicide were injected into the water as treatment for over 1,300 acres of giant salvinia in 7 different areas of the lake. Applications were made by LDWF personnel under the guidance of SePRO representatives. LDWF crews collected follow-up water samples for analysis by SePRO and documented condition of giant salvinia in the treated areas. The herbicide was applied utilizing 75% initially with 25% held in reserve for a "bump" treatment to maintain the target concentration level of 20 ppb. Utilizing water samples collected one week and then two weeks after application, SePRO made the recommendation to abandon treatment in several areas unless additional herbicide was purchased. According to information gained during meetings with SePRO representatives, concentration levels of herbicide had fallen off significantly in most treatment areas just 2 weeks after application. Clark's Bayou was the only area where concentrations remained at a level with the potential to provide control. A low to moderate Galleon concentration was measured in the upstream portion of Brushy Creek. However, concentration level had fallen off significantly towards the lower end. On July 14, 2009 the decision was made not to proceed with the bump treatment.

Approximately 7,386 acres of salvinia coverage was estimated during a helicopter flight on September 30, 2009. Following an extended high water event from early October through mid-November 2009, salvinia coverage was estimated at 4,606 acres on November 17, 2009.

The resulting 37% reduction in coverage can be largely attributed to giant salvinia flushing over the spillway as the lake level rose. At one time during this flood event, Lake Bistineau was approximately 6.5 feet above normal pool level. A second smaller high water event occurred from mid-December through the first few days of January, 2010.

Unusually cold temperatures the first two weeks in January 2010 resulted in most salvinia being encapsulated in frozen mats. Approximately 50% of the north end of the lake froze and most areas under the cypress trees froze. The majority of Lake Bistineau giant salvinia was located in these areas at the time of the freeze event. An inspection on January 12, 2010 revealed significant browning of the tops of the giant salvinia, but green viable plant tissue was observed on examination. Subfreezing temperatures of the prior two winters had imposed similar damage. Some of the plants to sank after the previous winters, but resurfaced and grew prolifically with warmer temperatures. Giant salvinia coverage was estimated at 3000 to 3500 acres in mid-January at the time of the inspection for freeze damage. This reduction from the mid-November estimate of 4,606 acres is most likely to be the result of flushing during the prior high water event.

On March 11, 2010 large amounts of salvinia were observed to be brown in color and in various stages of decay. Some green plant material remained in the mats of dead salvinia. Even though significant amounts remained, it was obvious that much of the salvinia had sunk. Observations from a survey conducted on March 23, 2010, included clear signs that salvinia had been heavily impacted by the freezing weather. There was no sign of regrowth. On April 6, 2010, small amounts of giant salvinia were found throughout the lake. This salvinia was scattered throughout the lake and likely would only total 1 or 2 acres if consolidated. Some remnants of the decaying vegetation remained in many areas of the lake at that time. Further inspections during May indicated salvinia remained at low levels. Giant salvinia coverage expanded in early June and began to exhibit normal growth patterns.

As spring rains began to slow, the lake level continued to fall towards the desired drawdown level of 8 feet below normal pool stage. Terrestrial vegetation such as sedges, grasses and ragweed covered the exposed lake bed as the waters receded. By mid-June of 2010, Lake Bistineau finally reached the target level of 8 feet below normal pool stage from the drawdown initiated on September 16, 2009. At this time the terrestrial vegetation growing on the lake bed was waist to chest high in many areas. The dense coverage of terrestrial vegetation holds moisture and is not conducive to effective drying of the lake bed. At the time the gates were closed on July 15, 2010, salvinia was flourishing again in most areas of the lake. One control gate was left open due to concerns over rapid inundation of the areas where dense terrestrial vegetation had grown during the drawdown. Submerging large quantities of this terrestrial vegetation at one time would greatly increase biological oxygen demand and increase likelihood of fish kills. The final gate was closed in early August after it became apparent that the lake level was not rising.

The growth of the terrestrial vegetation on the lake bed slowed later in the summer as the drought conditions persisted. As the grass began to die and become increasingly dry, fires occurred on several areas of the lake bed. These fires impacted approximately 1000 acres and significantly damaged the cypress timber. Several piers and boathouses were also burned.

The drawdown conditions likely prevented a rapid increase in coverage of giant salvinia throughout the summer as much of the shoreline was unprotected flats where the salvinia could wash up on the shore from wave action and be stranded. Despite foliar herbicide applications and the benefits of the drawdown conditions which persisted throughout the fall of 2010, giant salvinia expanded to approximately 500 acres by mid-October 2010. In early April there had been very little giant salvinia in the lake which had survived the freeze.

Freezing temperatures in early 2011 reduced salvinia to approximately 20 acres. By April, giant salvinia had expanded to the extent that it was necessary to supplement LDWF spray crews efforts with a contract treatment to 400 acres. In June, 2011 contract applications were made to 600 acres of giant salvinia. In September, 2011 contractors treated 700 acres of giant salvinia. A total of 3,508 acres of giant salvinia were treated on Lake Bistineau in 2011.

Lake Bistineau finally returned to pool stage on January 15, 2012 following the closure of the gates on July 16, 2010. The extended drawdown began on September 16, 2009. The winter of 2011 – 2012 was relatively mild in comparison to the previous two years. Salvinia coverage was estimated at approximately 50 acres in January 2012. By April, coverage had expanded to the point that private contractors were utilized to treat 300 acres. An additional 400 acres of giant salvinia was treated by contractors in May 2012. In June, containment boom was placed just north of the Port O' Bistineau to attempt to hold giant salvinia on the north end of the lake. Following placement of the boom, contractors were utilized to treat 800 acres in that area. In July, an additional 700 acres of giant salvinia was treated by contractors. A survey conducted in August 2012 revealed 2,300 acres of giant salvinia on Lake Bistineau. A drawdown was initiated on August 6, 2012. The control gates were closed on October 15th in an attempt to fluctuate the water level. In November, 580 acres of giant salvinia were treated by aerial application.

In January 2013, giant salvinia coverage was estimated at 900 acres. On January 15, 2013 the control gates were again opened to expose additional giant salvinia to desiccation and freezing temperatures. The control gates were closed January 31st. A 30 day contract was initiated on February 4, 2013 to be followed immediately by another subsequent 30 day contract. Despite ongoing foliar herbicide applications by LDWF contractors and spray crews, an estimated 3,899 acres of giant salvinia was observed on Lake Bistineau on June 11, 2013. The control gates were opened on June 24, 2013 to begin dewatering the lake to allow the giant salvinia to desiccate. Foliar herbicide applications continued as the lake dewatered.

Lake Bistineau was five feet below normal pool level by July 17, six feet low by August 1 and reached the target goal of seven feet below normal pool stage on August 20. Estimates made during a helicopter flight on September 5 showed approximately 850 acres of giant salvinia remained on the lake that had not been affected by the drying action or herbicide applications. The control gates were closed on December 2, 2013. The lake quickly returned to pool by December 18, 2013 due to rainfall. Two freeze events in the following weeks resulted in moderate ice formation on the lake surface which caused severe damage to much of the remaining giant salvinia.

By March of 2014, an estimated 56 acres of salvinia were observed on the lake. These plants were widely scattered over the entire lake and quickly began to expand as temperatures warmed. LDWF and contracted spray crews treated 1,318 acres of salvinia in the first half of 2014. By mid-July, the salvinia growth had exceeded the designated 1,500 acre trigger (approximately 1,725 acres) which prompted discussions and action to initiate a drawdown beginning on August 4, 2014. The gates were scheduled to be closed on December 1, 2014, but this date was altered to January 15, 2015 in response to a public opinion survey conducted by the Bistineau Task Force (BTF) in September 2014.

The survey was made available to the public by circulation in several media outlets. Interested individuals could mail in a survey form, complete the survey on-line, or provide the survey and related comments at the BTF's September meeting. All user groups completing the survey expressed a desire to extend the drawdown period beyond the planned December closing date. The January 15, 2015 closing date was chosen as a compromise to the public outcry without extending the date beyond a time where the closing date was not biologically sound. LDWF crews and contractors treated an additional 2,932 acres in the second half of 2014.

In 2014, two containment booms were installed around the public boat launches at the Bossier Parish Public Launch and State Park Area 1. LDWF crews intensely treated the area inside the boom to limit the amount of salvinia present around the launches. This allowed boaters to load and unload their boats with fewer inconveniences from salvinia and helped reduce the threat of transporting salvinia to other waterbodies. Both projects were met with positive response from the public as well as parish and State Park officials.

Two cold fronts in late February 2015 brought sleet and ice to the area. This greatly reduced the remaining salvinia in the lake following a successful drawdown. By early April, it was estimated that approximately 55 acres of salvinia remained in the lake. Herbicide efforts were continuous on the lake from mid-April through July. As in years past, salvinia began to expand rapidly around Memorial Day and then again around mid-July. An aerial survey conducted by LDWF personnel on July 17 estimated 1,781 acres of salvinia on the lake. A drawdown was initiated on August 3, 2015 to combat the growing plant problem.

A total of 149,900 weevils were stocked into Lake Bistineau in 2013. The weevils were released primarily in the borrow pits south of Interstate 20 and in the Crow's Foot and Bird Island areas of the lake. In 2014, 177,300 weevils were added in the Crow's Foot, Bird Island and Skinner's slough areas. The USACOE is monitoring the weevil populations at these sites and providing reports to LDWF.

In November of 2014, LDWF assisted entomologists from the LSU Agriculture Center Red River Research Station with deploying, stocking, and insulating four test plots in the Crow's Foot area of the lake. These test plots will be studied to better understand the weevil's response to cold weather and to help develop a more cold-tolerant strain of the insect. Samples indicated that very few weevils survived the harsh winter of 2013-14 and the related reduction in salvinia coverage.

Weevil stockings have occurred annually since 2007 (except 2010-2011). Nearly 2.3 million weevils have been stocked in Lake Bistineau. Weevil densities have been closely monitored in small enclosures and other isolated areas. To date, salvinia weevils have provided no measurable level of success on Lake Bistineau.

LDWF experience has clearly indicated that herbicide applications alone for control of giant salvinia are not effective. However, foliar herbicide applications are recognized as a legitimate component of a program that includes all available tools for control. An integrated management program that includes physical, chemical, and biological measures has resulted in improved control of giant salvinia. LDWF technical staff will remain receptive to consideration of any additional tools to add to the integrated management program. Critical evaluation of existing and proposed control measures will continue as part of an effort to combat this exceptionally prolific invasive species.

<u>Artificial Structure</u>

No artificial reefs have been placed in the lake by the Department of Wildlife and Fisheries. Man-made structures along the shoreline of the lake such as piers and boat houses, in addition to duck blinds and ski platforms in the open water areas do provide additional cover for fish. Some anglers place artificial structures and sunken tree tops in some areas of the lake to attract fish to their favorite fishing spots.

<u>Substrate</u>

The bottom substrate in many areas of Lake Bistineau is composed largely of organic detritus. Leaf litter from the cypress trees along with the overabundant aquatic vegetation in the lake is the major factor contributing to the buildup of organic material. Prior to impoundment, low water levels in the late summer and fall allowed aerobic decomposition of this organic material. With permanent impoundment, this material undergoes a much slower decomposition process through anaerobic activity. As a result, eutrophication has increased as the organic material on the lake bottom slowly decomposes. Spawning substrate was impaired and sportfish populations declined. Two consecutive midsummer drawdowns were conducted in 2004-2005, and 2005-2006 for the purpose of improving substrate. The drawdowns began on July 15 of each year and extended through the end of the following January. The lake was lowered 7 feet (maximum drawdown potential). Positive results were documented. The depth of the organic material was reduced in areas of the lake that were exposed to air. In some areas, sandy ridges were exposed as the organic material dried and decomposed.

Two methods were utilized to quantify the consolidation of the bottom sediments. Prior to implementing the drawdowns, the upper layer of many areas appeared to be comprised mostly of organic detritus in varying stages of decomposition. One method involved the use of an improvised device termed as the “muckometer.” This device was used to differentiate between soft and hard bottoms while the lake was at normal levels. A 12 inch diameter perforated aluminum disk was mounted on a length of pipe which served as a sleeve for a ½ inch metal rod which slid down to identify the hard bottom. This device was placed vertically in the water until the perforated disk contacted the soft bottom of the lake. The weight of the apparatus defined the depth of the soft bottom. A set screw was then loosened to allow the ½ inch metal rod to slide freely within the sleeve. A pressure scale was then used to apply 10 pounds of pressure to the top of the metal rod. The weight forced the rod through the soft organic material to hard bottom. The set screw was then tightened and measurements made of the rod protruding past the disk providing a rough estimate of organic material depth. Three measurements were made at each station. The results of these measurements are found in Figure 19.

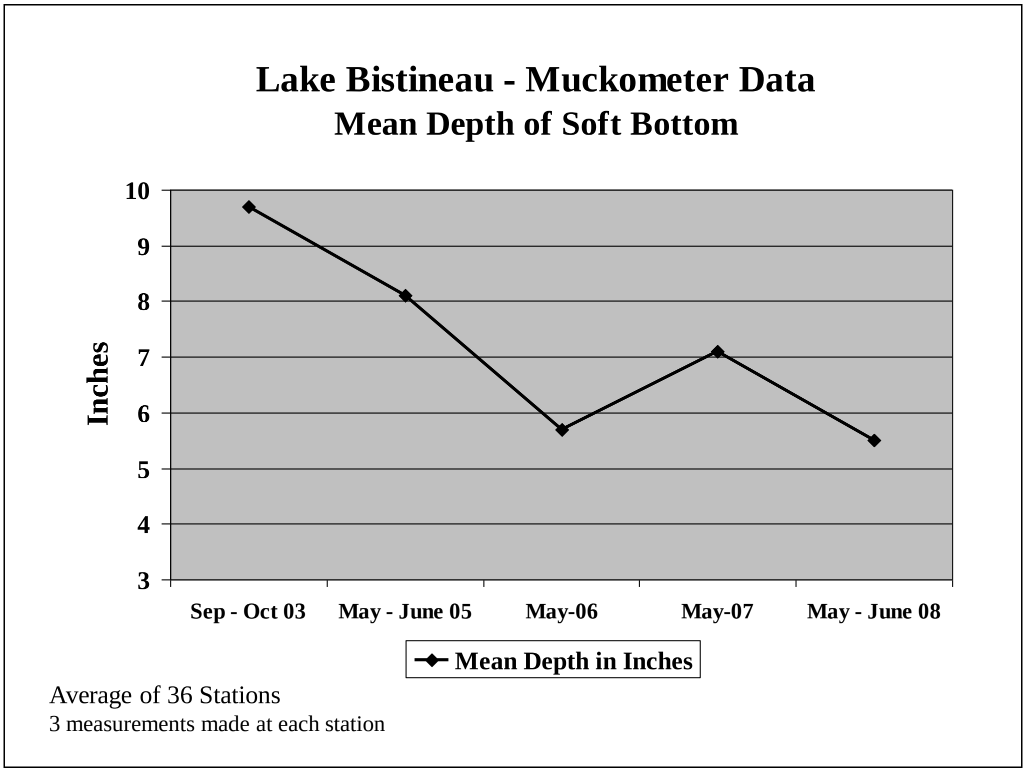

Figure 19. Sediment and organic detritus analysis of the bottoms of Lake Bistineau, LA, from 2003 – 2008. Values are reported in mean depth of accumulated soft bottom sediments and organics.

The results showed compaction of bottom substrates from dewatering the lake each year during mid-summer. Following the 2004 and 2005 drawdowns, the average depth of the soft bottom (organic material) was reduced by 40% for the entire lake bed with more drastic results observed in several locations. The initial sampling was conducted prior to the introduction of giant salvinia. However, measurements taken in 2008 revealed information about the increased rate of build-up of organic material in areas where salvinia mats persisted. Areas where salvinia was present for all of 2007 showed an average increase of 15% in organic material on the bottom from the measurements taken in early 2006. A similar area of the lake that did not have salvinia present was analyzed over the same time period and showed no increase in the average depth of the soft bottom.

The other method consisted of placing ¾" PVC stakes in the lake bed during the initial dewatering process of the 2004 drawdown. Stakes were pushed into the lake bed and then hammered in further to point of refusal for further penetration. The stakes were allowed to protrude 1.5 inches above the bottom substrate. After significant drying action occurred during the 2004 drawdown and in subsequent drawdowns, measurements of height that the stakes protruded were made. The difference in the heights roughly equates to the reduction in organic material at the site. Figure 20 provides a graphic representation of the compaction of the lake bed. Both methods indicate a significant consolidation of the bottom sediments following the drawdowns. Conversely, some accretion of bottom sediments occurred during periods when the lake was not influenced by a drawdown.

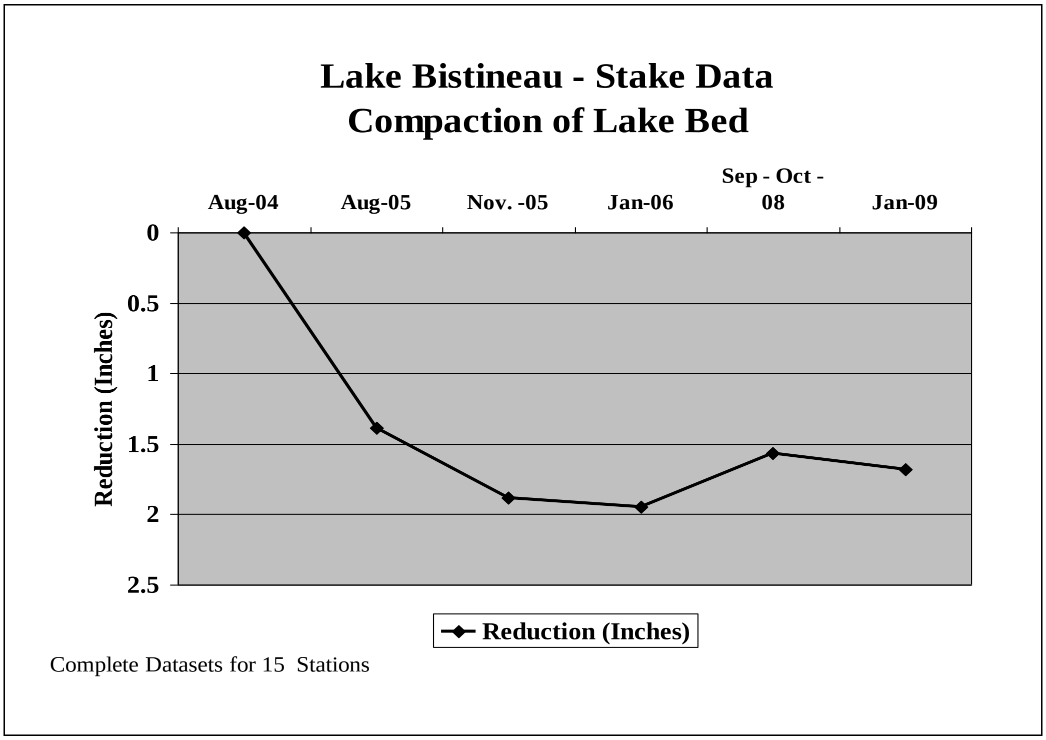

Figure 20. The compaction rates of sediments on the bottom of Lake Bistineau resulting from drying and desiccation of mud and organic detritus during periods of drawdown, for 2004 - 2009. Values are average reduction of the bottom sediments as compared to PVC stakes driven into the lake bed to the point of refusal at 15 different stations.

CONDITION IMBALANCE/ PROBLEM

Three major issues are threatening Lake Bistineau and hindering the successful management of the resources of the lake. The first is overabundant aquatic vegetation. Aquatic vegetation has been a problem since Lake Bistineau was impounded and the water regime changed from the natural fluctuation to permanent impoundment. Over the years, several species of aquatic vegetation have been problematic, but control was eventually achieved. Giant salvinia has proven to be an exception to date. The invasive species was discovered in 2006 and has confounded most control measures due to tremendous reproductive potential.

Habitat degradation has occurred from the accumulation of organic material. Prior to impoundment, natural low water periods during late summer and fall allowed for aerobic decomposition of organic material. The accumulation of organic material reduced quality nesting habitat resulting in an associated decline in sportfish production. Nest building sportfish species have increased abundance in association with recent dewatering events.

The third major issue on Lake Bistineau is the physical, geographical, and structural limitations of the reservoir. Lake Bistineau can be characterized as a permanently flooded swamp. It has expansive areas of shallow water that are prone to infestations of emergent and submerged aquatic vegetation. The dense stands of cypress trees prevent wind and wave action and provide ideal habitat for floating aquatic vegetation. Currently, the lake has limited drawdown capabilities combined with a large watershed.

CORRECTIVE ACTION NEEDED

The three major issues that exist with Lake Bistineau began when the reservoir was built in an area not suited to be permanently flooded. Making major changes to the reservoir such as re-designing the dam/control structure or removing large expanses of timber are cost-prohibitive, unrealistic, and would provide unknown results. Therefore, making such major changes is not recommended at this time for the control of giant salvinia.

Annual mid-summer drawdowns are needed to mimic the natural water regimes of the area. An annual drawdown strategy would help control excessive aquatic vegetation, reduce the buildup of organics, and improve aquatic habitats within Lake Bistineau. Currently drawdowns are the most cost-effective management tool available for Lake Bistineau. The consequences of abandoning drawdowns would include unchecked coverage of giant salvinia, increased accretion of organic material on the lake bottom, and a significant decline in sportfish abundance. Drawdowns may be inconvenient for some user groups, but the consequences of abandoning them are unacceptable. The recreational and economic value of the lake would rapidly decline. The strategy considers the interests of all user groups and attempts to maximize the recreational opportunities that exist on the lake while also improving the overall health and longevity of the lake.

RECOMMENDATIONS

1. Continue an integrated approach to control giant salvinia on Lake Bistineau. LDWF will use an integrated management program of water level fluctuations, herbicide applications, and biological control measures to achieve combined benefits. This approach is designed to reduce vegetation levels while maximizing the recreational use of the lake for activities such as fishing, boating, duck hunting, water sports, etc. This approach should also slow the eutrophication process on Lake Bistineau.

2. LDWF will conduct annual drawdowns of Lake Bistineau for organic reduction, aquatic habitat improvement, and giant salvinia control. LDWF biologists will estimate giant salvinia coverage in spring (early April), in mid-summer (early July), and at the conclusion of the drawdown (early December).

   Unless conditions dictate otherwise, a drawdown will be conducted with specific recommendations for dewatering as follows:

   - The gates will be scheduled to be opened on the last Monday in July each year (July 25-31).
   - The target water level for Lake Bistineau drawdowns is 8 feet below spillway crest height (maximum drawdown potential).
   - Dewatering rate should be 4-6 inches per day.

   The gates will be closed on November 30 each year. If November 30 is a Saturday or Sunday, then the gates will be closed on the following Monday. November 15th is the historical average-first-frost-date of the year for the area and represents the point where drying conditions will be diminished on the lake bed.

3. Conduct strategic foliar herbicide applications to giant salvinia and other noxious aquatic vegetation. The herbicide diquat will be used for giant salvinia control from November 1 through March 31 at 0.75 gallons per acre mixed with a total of 1 quart per acre of a 90:10 nonionic surfactant. Outside of that time frame, giant salvinia will be controlled with a mixture of glyphosate (0.75 gal/acre) and diquat (0.25 gal/acre) with Turbulence (0.25 gal/acre) surfactant. Major herbicide applications should only be used in conjunction with a drawdown.

4. Use of water soluble herbicides such as Galleon or Sonar will be considered for treatment of areas where salvinia remains in isolated waters during a drawdown or in other areas where applicable.

5. Continue scheduled standardized sampling of fish populations. A three-year population assessment study for largemouth bass and crappie will begin in 2016.

6. Continue Florida largemouth bass stockings.

7. Continue existing recreational and commercial harvest regulations until sampling results indicate a biological need to change management strategies.

8. Continue introductions of salvinia weevils. Monitor and relocate weevils throughout the lake. Assist LSU Agriculture Center / Red River Research Center with salvinia weevil research projects on Lake Bistineau and other area lakes.

9. Continue marking navigation channels on Lake Bistineau. Local parishes have provided some signs, but additional funding will be necessary to purchase the signs and other materials necessary to mark the entire lake. Work to develop partnerships to achieve this goal.

10. Initiate work to investigate logistics of strategic stump cutting and removal of other navigational hazards present during drawdowns.

11. Investigate and develop partnerships to expand access to the lake during drawdown periods.

Literature Cited

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